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I. Reference Materials

The following is a list of reference materials to be used in diversion design and construction.

a. Does proposed diversion have an adequate and stable outlet?
b. Determine diversion drainage area, average watershed slope, and weighted cover complex number.
c. Log soils in diversion and review soil survey data.
d. Is there a spring or base flow condition?
e. Check for buried utilities.
f. Determine engineering job class (job approval authority).

II. Site Investigation

The following is a list of items to be checked in the field:

a. Engineering Field Manual - Chapter Two and Nine
b. Supplement to Engineering Field Manual – Chapters Two and Nine
c. SCS-TP-61 - Handbook of Channel Design for Soil and Water Conservation
d. Section IV, Technical Guide, Practice Standard 362, Diversion
e. Hydrology Manual for North Dakota
f. Soil Survey Report
g. North Dakota Construction and Material Specifications for Conservation Practices
h. National Operation and Maintenance Manual

III. Design Surveys

Survey notes shall be kept in loose-leaf or bound field notebooks. The notes will be kept in a format similar to that shown in Technical Release 62, and Chapter I, Engineering Field Manual.

The surveyor will obtain the following information:

(1) Diversion Grade - Take centerline shots a minimum of every 100' along the centerline of the proposed diversion to determine the grade.

(2) Cross Sections - To determine the volume of earth work, cross sections are required. A detailed survey using an engineering level, rod, tape, etc. will be used to obtain necessary cross sections.

The spacing of the cross sections will be such that an accurate estimation of the earth work can be made.

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(3) Length – The length of the diversion will be determined by using a tape, chain, or other device which will insure the final recorded length is accurate.

IV. Design

The design of a diversion will be in accordance with Standard and Specification 362-Diversion, Section IV, Technical Guide. The steps in design are as follows:

a. Plot profile of channel and ridge, and cross sections on Form ND-ENG-59 as needed.

b. Determine the 24-hour peak discharge for the appropriate frequency storm for each reach. Form ND-ENG-31 will be filled out or Forms ND-ENG-8, ND-ENG-9, and ND-ENG-12, as appropriate. Chapter 5 of the Hydrology Manual for North Dakota or Chapter 2 of the Supplement to the Engineering Field Manual will be used for determining peak "Q"s.

c. Determine allowable velocities using tables in Standard and Specification 362 – Diversion, Section IV, Technical Guide or SCS-TP-61.

d. Determine the required diversions dimensions by using the tables in Chapter 9 of the Engineering Field Manual or the North Dakota Supplement or by using SCS-TP-61.

e. Determine earth work and seeding quantities. The volume of work in cubic yards will be determined by the method of average cross sectional end area. Cut-excavation tables in Chapter 9 of the Engineering Field Manual or the North Dakota Supplement may be used to determine areas of excavation on uniform slopes. Individual cross sections will be taken for non-uniform slopes.

f. Complete Form ND-ENG-35.

V. Construction Plans and Specifications

The cooperator, contractor, and the cooperator's file will be provided a set of plans and specifications for the diversion construction. The plans can be Form ND-ENG-35 and Form ND-ENG-59.

The plan will contain, as a minimum, the following:

a. Overall Plan View - Show stationing and identify reaches.

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b. Profile - Show original ground at channel centerline, proposed channel gradeline and ridge top.

c. Cross Sections - Show typical cross sections for each reach.

d. Construction Notes - All notes to clarify or furnish direction in construction.

e. Quantities - Estimates.

f. Job Approval

g. Construction specifications are to be provided with each set of plans. The North Dakota Construction and Material Specification for Conservation Practices shall be used for each item of work and material, as applicable or available. Additional specifications may need to be written to provide full material and installation instructions. A cover sheet and list of specifications is to be provided with the specifications.

VI. Layout

Layout surveys will be recorded in loose-leaf or bound survey books. Set necessary stakes for alignment, depth, width, and side slopes. Set grade stakes as needed. Survey notes will be kept in the format as shown in Chapter I, Engineering Field Manual and/or Technical Release 62.

VII. Compliance Checking - "As-Built" Plans

a. Compliance checking - Record in field notes

(1) Record a minimum of one cross section per reach not to exceed 400 feet between cross sections. Check centerline and ridge profile every 100 feet. Also note any low spots on ridge.

(2) Measure length and area seeded.

(3) Check all quantities.

(4) Statement of compliance on "as-built" plans – state the construction is complete according to plans and specifications. Date and sign by individual making determination and having job approval authority.

(5) Statement regarding adequacy or status of vegetation and topsoil placement.

(6) Complete Form ND-ENG-35 and Form ND-ENG-59, as appropriate.

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The key items to inspect on diversion construction are:

(1) Parabolic channel top width, trapezoidal channel bottom width, depth compliance, side slopes, ridge top width and depth of topsoil, as appropriate.

(2) Diversion grade compliance.

(3) Seeding - proper mixtures, drills, rates and techniques are followed.

b. "As Built" Plans

"As-built" plans are a record of constructed facilities. Changes from design are to be superimposed in a different color on the official file copy of the plans. On the "as-builts" show:

(1) Design changes.

(2) Changes in linear measurements.

(3) Final quantities.

(4) Identify "as-builts" on plans.